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ABSTRACT

One of a series of reports evaluating the Durham Education Improvement Program, this study concentrates on assessing the influence of age-of-entry on subsequent changes in performance on intelligence tests. Changes in intelligence quotient scores for two age-at-entry groups (3-, 4-, 5-year-olds combined and 6-year-olds) were correlated after one and two years of participation in the program. Although significant increases in measured intelligence were found after both one and two years in the program, no one entry age afforded greater increases in scores than another. (Tables are included). (WY)

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Effects of Age of Entry and Duration of Participation in a Compensatory Education Program

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The Durham Education Improvement Program*

This is one of a series of reports on the results of the studies conducted in the Durham Education Improvement Program, Duke University, Durham, North Carolina. The original proposal to the Ford Foundation for the Durham EIP projected the creation of a small scale school system in which approximately 200 to 300 children would be enrolled from ages 2 through 10. A small scale school system was created as a cooperative effort between the Durham City Schools, Durham County Schools, Duke University, North Carolina College, and Operation Breakthrough. In the fall of 1965, three public schools in the City of Durham and one in the County were selected as the target area schools since the children attending them came from geographical areas where low income families traditionally resided. In addition to the three target area schools a fourth City school near Duke University was chosen as a laboratory facility.

* The Durham Education Improvement Program: A project of the Ford Foundation under the auspices of the Southern Association of Colleges and Schools whose Education Improvement Project is funded by the Ford and Danforth Foundations. The Durham EIP is jointly administered by Duke University, North Carolina College, Durham City Schools, Durham County Schools, and Operation Breakthrough, Inc.

The overall strategy for the development of the model school system called for the development of new organizational patterns, procedures, and techniques of instruction at the laboratory school, with a concurrent introduction of tested school practices such as team teaching, ungraded instruction, programmed learning, and cross-age grouping in the target area schools.

Plans also called for the creation of a series of preschool classes to enroll children from 2 through elementary school age. A special classroom for very young children was constructed on the school grounds of one of the target area schools and some available rooms in the basement of the adjacent school were also modified to accommodate preschool children.

Children attending the preschools of the Durham EIP were chosen by random procedures from among the preschool population residing in the areas immediately surrounding the target area schools.

Basic Research Questions

Research in the Durham EIP is basically of a longitudinal nature and has been guided by several major questions:

1. What is the pattern of intellectual development of Durham's disadvantaged children, both black and white?

2. In what ways do girls display different developmental patterns than boys?

3. Does intelligence develop at an even rate during the very early period of growth and development from 2 through 10?

4. At which chronological age does intervention by EIP have the greatest impact on the intellectual and language development of disadvantaged children?

5. What combination of interventions appears to be most effective in overcoming the debilitating effects of economic and social restrictions?

6. How might public school personnel and responsible laymen concerned about public education reorganize or restructure public education to compensate for the characteristic deficits of disadvantaged children?

Data reported in this paper related to question #4 - That is, at what chronological age does intervention by EIP have the greatest impact on the intellectual development of disadvantaged children. In addition, data are also presented regarding the influence of one versus two years of participation in the Durham EIP.

Results

Table 1 presents the mean IQ scores and standard deviations, both at the time of entry into the Education Improvement Program and after one year in the Program. These data are reported for three age-at-entry groups: Three- and four-year-olds combined, five-year-olds, and six-year-olds. Data for all groups combined are also given.

Insert Table 1 about here

It can be observed that the measured mean IQ of all children combined increased during their first year in the program. The *t* test for correlated data for all groups combined revealed that an increase in IQ as large as found in the EIP sample would occur by chance less than once in a thousand similar samples ($p < .001$). It may also be noted by inspection of Table 1 that the greatest numerical increase in IQ occurred among children 3-4 years of age at entry. The standard deviation of IQ scores at age of entry among the three- and four-year-olds was quite high, possible reflecting a considerable lack of homogeneity in background experiences. The increase in measured IQ among the five-year-olds of 1.36 points was not statistically significant.

The correlation between IQ scores at entry with IQ scores after one year in the program was .76, which, while somewhat low, compares favorably with one-year lapse test-retest IQ correlations found in the general school population. It may be concluded from Table 1 that on the average the IQ scores of students increased significantly during their first year in the Durham Education Improvement Program and that the greatest improvements are made among children who enter the program at age three or four.

Table 2 presents similar data on IQ means and standard deviations for pupils in the Durham Education Improvement Program at time of entry and after two years of participation in the program. These data are reported for two age-at-entry groups: three-, four- and five-year-olds combined and six-year-olds. Data are also presented for all groups combined. Three-, four- and five-year-olds were combined because of

the small numbers at each of these entry ages who had participated in the program for two years or more.

Insert Table 2 about here

Table 2 reveals that the mean IQ of students in the Durham EIP was significantly higher after two years in the program for both age-of-entry groups as well as for all groups regardless of age of entry. A comparison of the data contained in Table 1 with that in Table 2 reveals that greater increases were found after two years in the program. These data are of special interest when compared to results obtained in other compensatory education programs as reported by Jensen (1969) and Karnes (1969).
In order to determine whether or not the amount of increase in measured IQ reported in Tables 1 and 2 is independent of the age of the pupil at entry into the Durham EIP, an analysis of covariance was computed.

Table 3 employed entry IQ score and IQ score after one year as covariants, while the analysis reported in Table 4 employed entry IQ score and score earned after two years in the program (Snedecor, 1956, pp. 394-404).

Insert Tables 3 and 4 about here

The analysis of covariance reveals that, with this sample, it cannot be concluded that there is any difference in the increase in average measured IQ that can be attributed to differences in start age in the program. The relatively high mean square for regression coefficients

is traceable to the high variability and low predicted value of the entry IQ scores among the three- and four-year-olds.

Summary

In summary, significant increases in measured IQ were found overall after one year in the program. The average increase in IQ for all age-at-entry groups after one year was 4.56. The covariance analysis revealed that one entry age could not be concluded to afford greater increase in IQ than another.

When data for pupils participating in the program for two years were examined, increases in average IQ were found to persist. The average increase in IQ scores over the two-year period was 8.14. Again the covariance analysis showed no significant differences in IQ gain with respect to age at entry. IQ scores among the three- and four-year-olds showed greater variability and less predictive value than among five- and six-year-olds.

With more children participating in the program in the current year who began participation at ages three or four, it will be possible to test further the influence of age of entry on subsequent changes in overall performance on tests of intelligence. These preliminary results suggest that the beneficial effects of the Durham EIP are extended at least through the second year of participation in the project.

References

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Table 1

Intelligence Quotient
Means and Standard Deviations
at Time of Entry and After One Year in EIP

		At Time of Entry[1]		After One Year[2]				
Age at Entry	N	Entry Mean	Entry S.D.	Second Mean	Second S.D.	IQ Change	t	p
3-4	24	86.59	20.93	93.27	15.37	+6.68	2.40	< .05
5	22	90.80	13.45	92.16	13.52	+1.36	< 1.00	
6	49	88.94	15.91	93.90	13.24	+4.96	3.33	< .01
All Groups	95	88.78	16.64	93.34	13.72	+4.56	4.11	< .001

$r_{(1st\ IQ \times 2nd\ IQ)} = .76$

[1] Stanford-Binet (Form L-M)

[2] WISC - Full Scale IQ

Table 2

Intelligence Quotient
Means and Standard Deviations
at Time of Entry and After Two Years in EIP

		At Time of Entry[1]		After Two Years[2]				
Age at Entry	N	Entry Mean	Entry S.D.	Second Mean	Second S.D.	IQ Change	t	p
3,4,5	24	90.12	20.66	96.66	15.95	+6.54	2.13	$< .05$
6	24	92.51	13.55	102.25	14.18	+9.74	4.37	$< .001$
All Groups	48	91.32	17.28	99.46	14.93	+8.14	4.40	$< .001$

$r_{(\text{1st IQ x 2nd IQ})} = .69$

[1]Stanford-Binet (Form L-M)

[2]WISC - Full Scale IQ

Table 3

Analysis of Covariance: Effects of Three Start Ages on IQ Change After One Year in EIP

(Adjusted for initial status on IQ)

	Start Age	df	Deviations from Regression Sum of Squares	Mean Square
Between (age groups)	3 or 4	22	2619.85	119.08
	5	20	1007.87	50.39
	6	47	2743.00	58.36
Within (age groups)		89	6370.71	71.58
Regression coefficient		2	335.32	167.66
Common		91	6706.03	73.69
Adjusted Means		2	189.77	94.88
Total		93	6895.80	

$$F = \frac{\text{Adjusted Mean Variance}}{\text{Common Variance}} = \frac{94.88}{73.69} = 1.29 \quad p > .10$$

where $n_1 = 2$ $n_2 = 91$

Table 4

Analysis of Covariance: Effects of Two Start Ages on IQ Change After Two Years in EIP

(Adjusted for initial status on IQ)

			Deviations from Regression	
	Start Age	df	Sum of Squares	Mean Square
Between (age groups)	3,4, or 5	22	3158.20	143.55
	6	22	1368.15	62.19
Within (age groups)		44	4526.34	102.87
Regression Coefficient		1	371.25	371.25
Common		45	4897.60	108.84
Adjusted Means		1	198.65	198.65
Total		46	5096.25	

$$F = \frac{\text{Adjusted Mean Variance}}{\text{Common Variance}} = \frac{198.65}{108.84} = 1.83 \quad p > .10$$

where $n_1 = 1$ $n_2 = 45$